

Pediatric Delirium Prevention using Nonpharmacological Bundles: A DNP Project

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Key Words: *Pediatric delirium, Delirium, Nonpharmacological bundles, Delirium prevention*

Abstract

Introduction: Pediatric delirium has a 25% prevalence rate in the pediatric intensive care unit (PICU). The project purpose was to implement a nonpharmacological nursing bundle in the PICU to assess the effects on delirium reduction.

Method: A nonpharmacological nursing bundle was implemented for PICU patients, 2-18 years of age, admitted to an Arizona metropolitan, children's hospital. Data was collected using the Cornell Assessment of Pediatric Delirium (CAP-D) screening tool.

Results: Prebundle CAP-D and postbundle CAP-D scores ($M=5.57$, $SD=5.78$; $M=7.10$, $SD=5.61$) did not differ among the participants. Prebundle participants required an intervention 26.7% of the time for delirium compared to 31.6% in the postbundle population. No statistical significance was seen between the prebundle and the postbundle CAP-D scores $t(59)=7.46$; $t(205)=18.17$ ($P=0.08$, fisher's exact test).

Discussion: Nonpharmacological bundles for delirium prevention are needed in the PICU. This project shows that significant barriers exist when implementing them in a complex pediatric environment.

Key Words: *Pediatric delirium, Delirium, Nonpharmacological bundles, Delirium prevention*

Pediatric Delirium Prevention using Nonpharmacological Bundles: A DNP Project

Delirium is a clinical phenomenon that affects both adults and children with critical illnesses. Delirium is defined by the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) as an “acute disturbance in level of consciousness, attention, cognition, and perception that develops over a short period of time and can have fluctuations” (American Psychiatric Association, 2000). Although this phenomenon was initially identified in adults, pediatric delirium (PD) has now been recognized as a significant clinical issue affecting children in critical care settings (Traube et al., 2017).

Background

Pediatric delirium is a neuropsychological problem that affects patients in the pediatric intensive care unit (PICU) with a previously reported prevalence rate of 4.5% - 28% (Silver et al., 2015; Van Tuijl, Van Cauteren, Pikhart, Engel, & Schieveld, 2015). A recent point prevalence study in 25 PICUs across the world report a 25% prevalence rate, adding to the evidence that this is a frequent problem experienced by children in the PICU (Traube et al., 2017). PD has a significant impact on patients, caregivers, providers, and the healthcare system. Research demonstrates it increases length of hospital stays, increases ventilator days, increases healthcare costs, contributes to patient, family, and provider stress, and increases the risk of neurocognitive impairment (Van Tuijl et al., 2015). Delirium is a well-known entity in adults but is not well understood in the pediatric population because there is a paucity of research and because of developmental differences that exist in the pediatric population (Leentjens et al., 2008). The lack of pediatric specific delirium education, proper use of validated screening tools, and lack of use of nonpharmacological bedside nursing bundles create barriers in critical care

settings that affect both the diagnosis and prevention of PD (Flaigle, Ascenzi, & Kudchadkar, 2016; Schieveld et al., 2007).

Despite the large volume of evidence that supports the diagnosis and treatment of delirium in adults, delirium has only recently been identified as a clinical phenomenon in children. There are several factors associated with the lack of literature regarding pediatric delirium. These include lack of awareness by providers regarding the clinical condition, differences in the pathophysiology of PD compared to adult delirium, and difficulties in diagnosis and management associated with developmental differences (Creten, Van Der Zwaan, Blankespoor, Leroy, & Schieveld, 2011). Several theories have been proposed regarding the pathophysiology of PD including imbalances in neurotransmitter systems, associations with the septic (neurological) inflammatory pathway, and aberrant stress response, making the ability to diagnose PD very difficult (Van Tuijl et al., 2015).

The clinical syndrome of PD also differs from that of adults. Smith et al. (2013) reported that critically ill children had similar delirium symptoms to adults including sleep disturbances, orientation difficulties, and attention difficulties. However, critically ill children with delirium differ from adults by expressing more distinctive symptoms including restlessness, inability to control emotions, inability to be consoled by caregivers, and vitals sign changes regulated by the autonomic system (Smith et al., 2013). Subtle clinical signs have also been associated with PD including deterioration of developmental milestones, lack of eye contact with providers, and changes in emotional interactions with their parents (Hatherill & Flisher, 2010).

The development of PD is influenced by underlying and acquired factors. Underlying risk factors include, an early age, ranging from 3-7 years old, being male, cognitive disabilities, psychological or emotional disorders, chronic disease states, anxiety disorders, having a family

member who suffered from delirium, and lack of caregiver presence. Acquired factors are, the child's primary diagnosis, mechanical ventilation, oxygen therapy, deep levels of sedation, restraints, loud, dark, secluded environments, lack of provider consistency, medication use, especially benzodiazepines, auditory or visual impairments, and lack of mobility (Hatherill & Flisher, 2010; Silver et al., 2015; Traube et al., 2017; Van Tuijl et al., 2015;). Children who are critically ill often have all of these underlying risk factors. Improvement in provider understanding of the risk factors could improve screening and prevention.

The sequelae for children who develop PD are significant. Although research is limited, PD has been linked to longer hospital stays, prolonged ventilator days, longer stays in the pediatric intensive care unit (PICU) stays by 2.4 days, increased health care costs by at least 1.5%, and potentially higher morbidity and mortality rates (Leentjens et al., 2008; Silver et al., 2015; Smeets et al., 2010; Van Tuijl et al., 2015). Long-term sequelae that have been documented are prolonged absenteeism from school, impaired ability for advanced learning, significant family stress, and approximately 1/3 of children will develop post-traumatic stress disorder (PTSD) 3-months after hospital discharge (Schieveld & Janssen, 2014; Smith et al., 2013). Despite the paucity of literature focused on PD, these documented outcomes are a catalyst for critical care providers to begin to realize the importance of PD and the long-term effect it has on children that are being treated in the PICU.

Delirium is widely accepted as a condition and has many risk factors that lead to its development (Greve et. al., 2012). Nonpharmacological nursing interventions provide an opportunity for nurses to alter and treat the risk factors associated with delirium. Although the pediatric literature is scarce, there are several nursing interventions that are showing promise as interventions for bedside use. These interventions include day/night cycles, noise reduction

strategies, orientation strategies including calendars or clocks, memorable items from home, bedside parental presence, primary nursing care, parental education regarding delirium, pain management, timely removal of catheters and restraints, and the use of visual/auditory aids like glasses or ear plugs are all interventions being evaluated in the pediatric trials (Hatherill & Flisher, 2010; Smith et al, 2013; Van Tuijl et al., 2015). Although concrete pediatric data is lacking, multiple studies in adults are showing promising outcomes for decreased delirium prevalence when implementing multicomponent nursing bundles in the critical care setting (Bounds et al., 2016; Rivosecchi et al., 2015; Smith & Grami, 2017; Sullinger et al., 2017). As the adult literature becomes more robust, the ability for pediatric critical care providers to use this evidence for pediatric multicomponent nursing bundles provides great promise for the prevention of PD.

Recent data from a 2017 point prevalence study shows a 22% prevalence rate ($N=54$) of PD in the project site PICU which is consistent with the overall finding of 25% in worldwide delirium prevalence (Buttram, 2017; Traube et al., 2017). PD was seen most commonly in patients with cardiac disease ($n=20$), followed by patients with acute respiratory failure ($n=14$), patients with neurological diseases ($n=7$), patients with hematological/oncological diseases ($n=6$), patients with infectious/inflammatory diseases ($n=4$), and patients with renal/metabolic diseases ($n=3$) (Buttram, 2017). The purpose of this project was to implement an evidenced-based, nonpharmacological nursing bundle to assess the effects of reducing the incidence of delirium in the PICU.

Methods

Setting and Participants

The project was completed at a 350-bed children's hospital in the Phoenix metropolitan area. The mission of the children's hospital is to provide the best healthcare to children and their

families through hope and healing (www.phoenixchildrens.org). The hospital strives to be the premier children's hospital in the Southwest through comprehensive and innovative pediatric care by valuing advanced education for their providers and being strong advocates for the children in Arizona (www.phoenixchildrens.org).

Children admitted to the PICU, ages 2-18, for > 48 hours were eligible for delirium screening between October 1, 2017 to December 31, 2017. Informed consent was not required as no personal identifying information was collected.

Study Design

A review of the adult and pediatric delirium literature was completed using CINALH, PubMed, Cochrane Library and PsycINFO. An evidenced-based, nonpharmacological bundle was created based off the conclusions from the review (Figure 1). Nonpharmacological interventions included day/night cycles, sleep promotion techniques, family presence, orientation practices, noise reduction and medical team surveillance of lines, catheters, and restraints. The project was determined to be a quality improvement project by the project site, subsequently institution board review (IRB) approval was not required. The project was also submitted to the Arizona State University IRB process for approval. A pre-project survey was conducted to assess baseline nursing knowledge regarding delirium, delirium screening, and nonpharmacological ways to treat delirium. A learning module was generated based on the nursing survey results and was distributed to the nursing staff via the online learning module system that the unit uses for education. The learning moduled provided education to the nurses on delirium, delirium screening, and the new nonpharmacological nursing bundle being implemented in the PICU.

The Cornell Assessment for Pediatric Delirium (CAP-D) screening tool was used to assess the incidence of pediatric delirium at the project site. The CAP-D has strong specificity and

sensitivity (79.2%, 94.1%) making it a reliable tool for pediatric delirium screening (Traube et al., 2014). Retrospective CAP-D data was analyzed from October 1, 2016 to December 31, 2016 prior to bundle implementation. The nonpharmacological bundle was implemented on October 1, 2017. CAP-D data from October 1, 2017 to December 31, 2017 was prospectively analyzed.

A post project nursing survey was distributed to the nurses to evaluate the barriers for effective delirium screening and implementation of the nonpharmacological nursing bundle. Survey questions focused on barriers that are perceived by the nurses that inhibit effective delirium screening; suggestions from nursing to improve delirium screening rates; additional support that could have been available to implement the bundle more effectively; and finally what suggestions nursing had to improve the use of the nonpharmacological bundles in the PICU environment. The survey was conducted to evaluate why the results did not reach statistical significance and what improvements can be made in the future to improve bundle compliance and use.

Outcome measures and Data Analysis

The primary outcome of this project was to assess the impact on CAP-D scores from implementation of the nonpharmacological nursing bundle and the incidence of delirium in the PICU for children 2-18 years of age. A secondary outcome assessment was delirium screening rates. All statistical analyses were completed using SPSS Version 24. Descriptive statistics using frequencies were used to assess the pre and post bundle CAP-D scores. CAP-D scores of ≥ 9 required intervention and are reported as percentages. A one sample t-test was used to determine mean and standard deviations for pre and post CAP-D scores. A fisher's exact test was used to determine statistical significance of the nonpharmacological nursing bundle on CAP-D scores. A P value of ≤ 0.05 is considered statistically significant.

Results

A retrospective data review revealed that 108 patients, ages 2-18 years, were admitted to the PICU from October 1, 2016 to December 31, 2016. Of those 108 patients, 7 patients were screened for delirium resulting in a 6% screening rate. This was compared to prospective data collected from October 1, 2017 to December 31, 2017 resulting in 213 admissions, ages 2-18 years, with 20 patients screened, yielding a 9% screening rate. Nursing education regarding delirium screening prior to bundle implementation was not statistically significant with a 3% increase in screening rates.

Prebundle CAP-D and postbundle CAP-D scores ($N=60$, $M=5.57$, $SD=5.78$; $N=206$, $M=7.10$, $SD=5.61$) did not differ among the participants (Table 1). The prebundle participants required an intervention 26.7% of the time for their delirium compared to 31.6% in the postbundle population (Table 2). No statistical significance was seen between the prebundle and the postbundle patients $t(59)=7.46$; $t(205)=18.17$ ($P=0.08$, fisher's exact test) and their CAP-D scores (Table 3).

Discussion

Delirium has become a common phenomenon in the PICU environment. In adults, the use of Awakening and Breathing Coordination, Delirium monitoring/management, and Early exercise and mobility (ABCDE) bundles have produced statistically significant improvements in delirium prevention (Bounds et al., 2016; Rivosecchi, Kane-Gill, Svec, Campbell, & Smithburger, 2016; Smith & Grami, 2017; Sullinger et al., 2017). Studies regarding at the use of nonpharmacological nursing bundles in the PICU environment are scarce. Simone et al. (2017) implemented a multidisciplinary delirium bundle in a single PICU resulting in decreases in delirium rates. The common theme amongst the delirium literature is that multicomponent bundles are more effective at reducing delirium than single component bundles because the bundles

directly target the risk factors that are known to trigger delirium (Hatherill & Flisher, 2010; Simone et al., 2017; Smith et al, 2013; Van Tuijl et al., 2015)

The aim of this project was to contribute to the growing body of evidence regarding delirium in the pediatric critical care population. The project site's delirium rates were consistent (22%) with the worldwide prevalence rate (25%) making this an important area to address in this unit (Buttram, 2017; Traube et al., 2017). Despite surveying nurses and constructing a mandatory delirium learning module for the nursing staff, screening rates in the project site did not significantly increase from 2016 to 2017, 6% to 9%. These results are consistent with the pediatric critical care literature reporting that only 2% of PICUs are screening for delirium (Traube et al., 2014). Along with lack of screening, medical staff knowledge deficits regarding delirium have been reported as limiting factors for delirium screening and treatment (Flaigle, Ascenzi, & Kudchadkar, 2016).

The implementation of a nonpharmacological bundle did not lead to statistically significant ($P=0.08$, fisher's exact test) changes in CAP-D scores or in delirium prevention. A postbundle survey was conducted with nursing to investigate factors that may have contributed to the findings. Nurses reported that not having the CAP-D screening form as a standard part of their electronic charting resulted in them forgetting to add the parameter and screen for delirium. The current charting system in the PICU allows the nurses to electively add the CAP-D screening tool to their charting. The elective decision not to add the screening tool, led to patients not being screened and not receiving the nonpharmacological nursing bundle.

The nurses also reported in the survey that they did not like the standard screening times of noon and midnight, feeling that the delirium screening gets forgotten about during their busy shifts. There were reports of difficulties understanding the screening for patients requiring sedation and/or

intubation, younger patients such as infants, and patients with developmental differences. The nurses also report a lack of trust in the medical team to treat the delirium when they notified the team of high delirium scores. The results of the postbundle survey highlight the importance of interprofessional involvement when implementing bundles or protocols into complex areas like the PICU.

While this project did not produce statistically significant results, several important lessons were learned for providers interested in implementing nonpharmacological bundles in the PICU environment. First, creating and sustaining buy-in from all members of the interprofessional team is important. Buy-in for this project was created early but was not sustained throughout the project which may have led to the lack of bundle use. Second, providing upfront and ongoing education about delirium and how to screen will help those screening for delirium to be more effective. The postbundle survey shows that nurses at the project site need more education regarding delirium and how to screen patients who were more complex, younger, and who had developmental differences. Third, it is anticipated that making the screening process easier for nursing will result in better screening rates. At the onset of the project, attempts were made to get the CAP-D screening tool incorporated into the standard nursing charting. Unfortunately, despite working with the information technology department, these efforts were not successful. Having a screening tool as part of the standard assessment will likely improve the routine screening for delirium. Fourthly, repeat evaluation of the process with a plan-do-study-act (PDSA) cycle in the middle of project may have lead to better results. Barriers may have been discovered earlier that could have been addressed to support better implementation. Finally, improving trust between nursing and medical providers that treatment will occur when delirium is recognized should improve treatment and overall results for patients in the PICU environment.

Several important limitations exist for this project. First the project was completed in a single, metropolitan children's hospital's PICU limiting generalizability to other healthcare institutions and settings. Although the CAP-D is a validated, reliable tool, subjectivity from the nurses can create interrater reliability issues leading to overestimates or underestimates of delirium. Fluctuations in patient census may affect results because only those patients in the PICU for > 48 hours were eligible for screening. Finally, knowledge and attitudes regarding delirium from the staff have the ability to significantly affect buy-in and the final results.

Conclusions/Implications for practice

The occurrence of delirium in the pediatric intensive care unit has become a common phenomenon. The use of nonpharmacological nursing bundles are an important element to effectively prevent and treat delirium. The use of a strong interprofessional team, the removal of screening obstacles, creating effective buy-in, promoting continuous delirium education, and repeat evaluation of the process may help providers employ successful nonpharmacological bundles resulting in improvements to pediatric delirium care and overall patient outcomes.

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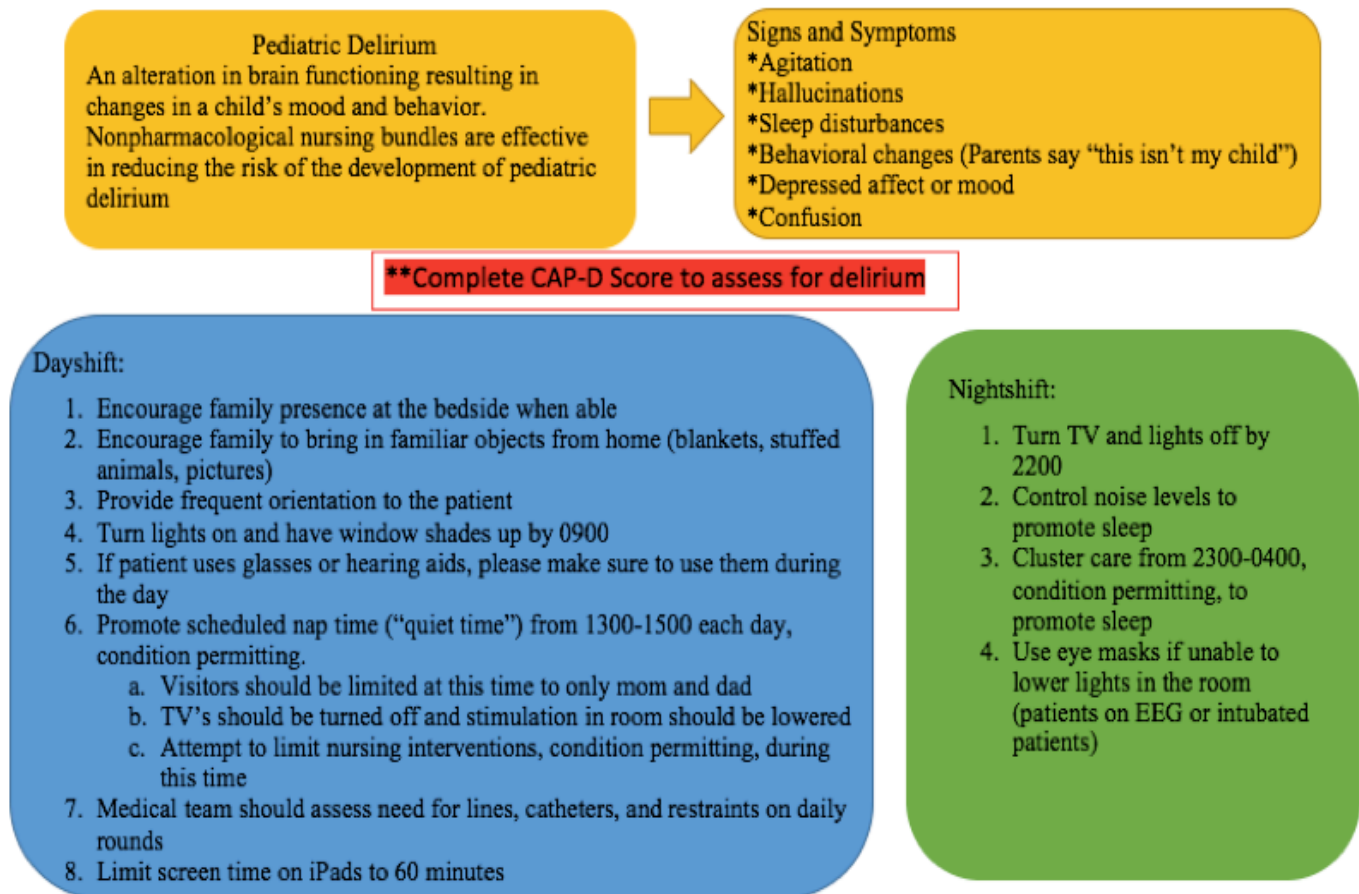


Figure 1. Nonpharmacological nursing bundle tool for the bedside. CAP-D= Cornell Assessment for Pediatric Delirium. The bundle incorporates the definition of delirium according to the DSM-IV criteria for mental disorders, signs and symptoms of delirium, and bundle components encouraged for both dayshift and nightshift

Table 1

One sample *t*-test of pre CAP-D scores vs. post CAP-D scores

Scores	<i>N</i>	Mean	Std. Deviation
Pre CAP-D	60	5.57	5.78
Post CAP-D	206	7.10	5.61

Note: CAP-D= Cornell Assessment for Pediatric Delirium; *N*=sample

Table 2

Intervention Required for CAP-D Score ≥ 9 Pre and Post Bundle Implementation

	Pre-Intervention			Post-Intervention		
	<i>f</i>	%	Valid %	<i>f</i>	%	Valid %
No intervention	44	21.4	73.3	141	68.4	68.4
Yes intervention	16	7.8	26.7	65	31.6	31.6

Note: CAP-D= Cornell Assessment for Pediatric Delirium; *f*= frequency; %= percent; valid %= valid percent.

Table 3

Pre and Post CAP-D results on delirium reduction

	<i>t</i>	<i>df</i>	<i>M</i> Difference	95% CI		<i>p</i>
				Lower	Upper	
Pre CAP-D score	7.46	59	5.57	4.07	7.06	
Post CAP-D score	18.17	205	7.10	6.33	7.87	0.08

Note: CI= confidence interval; *df*= degrees of freedom; *M*=mean difference; Pre-CAP-D= pre bundle implementation Cornell Assessment of Pediatric Delirium score; Post-CAP-D=post bundle implementation Cornell Assessment of Pediatric Delirium score; *t*=student's *t* distribution.

**p* < .05

